REPORT DOCUMENTATION PAGE

The reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE 11/19/96	3. REPORT TYPE AND DATES COVERED Progress 1/1/96 - 12/31/97

4. TITLE AND SUBTITLE	5. FUNDING NUMBERS
"High Performance Computer Models in Computational Acoustics"	N00014-96-1-0442 PR # 96PR03456-00

6. AUTHOR(S)

Diana C. Resasco
Martin Schultz, P.I.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
Yale University Suzanne K. Polmar, Ph.D. Director Grant and Contract Administration 12 Prospect Place New Haven, CT. 06511-3516	622A-31-42284

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSORING/MONITORING AGENCY REPORT NUMBER
Administrative Grant Officer Office of Naval Research Regional Office 495 Summer Street Room 103 Boston, MA 02210-2109	N00014-96-1-0442

11. SUPPLEMENTARY NOTES

None

12a. DISTRIBUTION/AVAILABILITY STATEMENT	12b. DISTRIBUTION CODE
Unlimited DISTRIBUTION STATEMENT A Approved for public release Distribution Unlimited	

13. ABSTRACT (Maximum 200 words)

The long term goals of this project is to develop accurate models and efficient algorithms for the numerical solution of wave propagation problems for Navy applications.

19961125 006

DTIC QUALITY INSPECTED 3

14. SUBJECT TERMS			15. NUMBER OF PAGES 3
3-dimensional coupled wave propagation, FOR3D code, parabolic elastic wave equations			16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

GENERAL INSTRUCTIONS FOR COMPLETING SF 298

The Report Documentation Page (RDP) is used in announcing and cataloging reports. It is important that this information be consistent with the rest of the report, particularly the cover and title page. Instructions for filling in each block of the form follow. It is important to *stay within the lines* to meet *optical scanning requirements*.

Block 1. Agency Use Only *(Leave blank)*.

Block 2. Report Date. Full publication date including day, month, and year, if available (e.g. 1 Jan 88). Must cite at least the year.

Block 3. Type of Report and Dates Covered. State whether report is interim, final, etc. If applicable, enter inclusive report dates (e.g. 10 Jun 87 - 30 Jun 88).

Block 4. Title and Subtitle. A title is taken from the part of the report that provides the most meaningful and complete information. When a report is prepared in more than one volume, repeat the primary title, add volume number, and include subtitle for the specific volume. On classified documents enter the title classification in parentheses.

Block 5. Funding Numbers. To include contract and grant numbers; may include program element number(s), project number(s), task number(s), and work unit number(s). Use the following labels:

C	- Contract	**PR**	- Project
G	- Grant	**TA**	- Task
PE	- Program Element	**WU**	- Work Unit Accession No.

Block 6. Author(s). Name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. If editor or compiler, this should follow the name(s).

Block 7. Performing Organization Name(s) and Address(es). Self-explanatory.

Block 8. Performing Organization Report Number. Enter the unique alphanumeric report number(s) assigned by the organization performing the report.

Block 9. Sponsoring/Monitoring Agency Name(s) and Address(es). Self-explanatory.

Block 10. Sponsoring/Monitoring Agency Report Number. *(If known)*

Block 11. Supplementary Notes. Enter information not included elsewhere such as: Prepared in cooperation with...; Trans. of...; To be published in.... When a report is revised, include a statement whether the new report supersedes or supplements the older report.

Block 12a. Distribution/Availability Statement. Denotes public availability or limitations. Cite any availability to the public. Enter additional limitations or special markings in all capitals (e.g. NOFORN, REL, ITAR).

DOD	- See DoDD 5230.24, "Distribution Statements on Technical Documents."
DOE	- See authorities.
NASA	- See Handbook NHB 2200.2.
NTIS	- Leave blank.

Block 12b. Distribution Code.

DOD	- Leave blank.
DOE	- Enter DOE distribution categories from the Standard Distribution for Unclassified Scientific and Technical Reports.
NASA	- Leave blank.
NTIS	- Leave blank.

Block 13. Abstract. Include a brief *(Maximum 200 words)* factual summary of the most significant information contained in the report.

Block 14. Subject Terms. Keywords or phrases identifying major subjects in the report.

Block 15. Number of Pages. Enter the total number of pages.

Block 16. Price Code. Enter appropriate price code *(NTIS only)*.

Blocks 17. - 19. Security Classifications. Self-explanatory. Enter U.S. Security Classification in accordance with U.S. Security Regulations (i.e., UNCLASSIFIED). If form contains classified information, stamp classification on the top and bottom of the page.

Block 20. Limitation of Abstract. This block must be completed to assign a limitation to the abstract. Enter either UL (unlimited) or SAR (same as report). An entry in this block is necessary if the abstract is to be limited. If blank, the abstract is assumed to be unlimited.

PART A
------

1. Principal Investigator: Diana C. Resasco, Martin H. Schultz
2. Title: High Performance Computer Models In Computational Acoustics
   (N00014-96-1-0442) 1/1/96 - 12/31/97
3. Address: Diana C. Resasco
    Yale University
    Department of Computer Science
    P.O. Box 208285
    New Haven, CT   06520-8285
4. Internet email addresss: resasco@cs.yale.edu   schultz@cs.yale.edu
5. Phone: (203) 432-1207   FAX: (203) 432-0593
6. Category of Research: Propagation (theory, modeling & computation)

PART B
------

1. Long Term Goals
   To develop accurate models and efficient algorithms for the
   numerical solution of wave propagation problems for Navy
   applications.

2. Scientific and Technological Objectives
   Through our continued collaboration with Dr. Ding Lee, our objective
   is the development of a 3-dimensional coupled wave propagation model
   in a fluid-elastic environment.

3. Background
   In previous years, the Computational Ocean Acoustics group at Yale
   has contributed through the design and analysis of new numerical
   schemes, the enhancement of the FOR3D code, and its implementation
   on parallel machines. The fluid-elastic model will be considered an
   important extension of the code.

4. Approach
   We continue to work with Dr. Lee in the development and analysis
   of the mathematical model. Issues that require special attention
   include the numerical implementation of the solution to a complex
   system of differential equations that results from a parabolic
   approximation of the problem, stability analysis and efficient
   implementation.

5. Accomplishments and Results

In recent fiscal years, the group at Yale contributed through the design and implementation of fast algorithms for PE approximations and the development of parallel algorithms and their implementation on parallel supercomputers.

This fiscal year, we collaborated with Dr. Lee in the development of a numerical solution to the parabolic elastic wave equations developed by Lee et.al. on the previous FY.

A set of fluid-elastic interface conditions has been formulated in ODE form which can be incorporated to the coupled 3D fluid-elastic interface model.

We continue to collaborate with Dr. Lee in the development and analysis of numerical techniques to solve the resulting coupled system. A paper reporting preliminary results on the elastic model is in preparation.

Yale continues to sponsor and contribute to the International Conference on Theoretical and Computational Acoustics, which provides a forum for the discussion of state-of-the-art development and results in the field of acoustics.

6. Impact on S & T

The FOR3D model and code has been a useful tool for research, application and reference for many users worldwide. We expect that the added capabilities of a fluid-elastic environment will make it even more useful to practicing acousticians.

7. Relationship to other Projects

This research project is related to Computational Shallow Water Acoustics.

FY96 STATISTICAL INFORMATION

1. Diana C. Resasco - Martin H. Schultz
    Yale University
    Department of Computer Science
    P.O. Box 208285
    New Haven, CT   06520-8285

2.   Book (authored): NUMERICAL ACOUSTIC PROPAGATION IN THREE DIMENSIONS
            Ding Lee and M.H.Schultz
                World Scientific Pub. Co., Singapore, 1995
        Book (Edited): THEORETICAL AND COMPUTATIONAL ACOUSTICS '95
            Ding Lee,Y-H.Pao,M.H.Schultz and Y-C. Teng
            World Scientific Pub. Co., Singapore, 1996

Graduate students (state if female or minority)
None

PostDocs
None

Percentage of funds sent on to other performing organizations
None